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ABSTRACT

This study was designed to determine if the failure of previous investigations to find habituation and response to novelty in infants younger than 2 months of age was because the stimuli used were too complex or because a constant number of trials rather than an individual criterion of habituation was used. A total of 24 infants between 5 and 6 weeks of age were divided into three groups and given pretest to show that they had no initial preference for either of two stimuli, which differed in complexity. Next, all infants were given some familiarization with one of the stimuli, followed by a posttest on both stimuli. During the familiarization period, the three groups were treated differently: each of two groups was familiarized with either the complex or simple stimulus, and the third group was familiarized with the complex stimulus, but allowed only half as many familiarization trials. Results indicate that: (1) 5-week-old infants do habituate to visual stimuli, (2) previous failures to demonstrate habituation were due to stimulus and procedural limitations, and (3) preference for novelty is found following attainment of individual habituation criterion, while preference for familiarity is found following a period of familiarization too short to permit attainment of such a criterion. (BRT)

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Visual Habituation and Preference for Novelty in Five-week-old Infants.

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Several reviewers have pointed out in recent years that in spite of the impressive demonstrations of classical conditioning and instrumental learning in neonates and very young infants, the numbers of trials and the methodological complexities involved in such demonstrations seem to argue against those learning mechanisms being the major processes through which behavioural change occurs in the infant in real life. Some simpler mechanism of modifiability seems to be called for, and at this point, habituation is the mechanism of choice for many experimenters. It is a process that has traditionally been considered neither growth nor true learning, and it has been demonstrated in a wide range of species, some of which do not show classical or operant learning.

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There is, however, a stumbling block in the promotion of habituation as a major mechanism in the first few months, that being the embarrassing fact that habituation--at least to visual stimuli--has been as difficult to obtain in young infants as have more complicated forms of learning. In 1971 Jeffrey and Cohen pointed out that visual habituation had not been adequately demonstrated in infants younger than 2 months old, and Cohen and Gelber (in press) interpret currently available data on this point as conflicting. These reviewers have suggested that age differences in habituation may possibly reflect basic changes in infant capabilities with age.

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Paper presented at meetings of the Society for Research in Child Development, Denver, Colorado, April, 1975.

While most investigators who have tried to habituate infants less than 2 months old to visual stimuli have met with complete failure, there are at least two investigators who have found such habituation in some subjects. In two studies (Friedman, 1972; Friedman, Bruno, and Vietze, 1974) Friedman has found habituation in some proportion of neonates, when an 8-second decrement in looking time was used as the habituation criterion. Self (in press), working in Horowitz's lab, found habituation in some of her 5-week-old subjects. Both Friedman and Horowitz have argued persuasively that two months does not represent any developmental barrier for the capacity to habituate to visual stimuli, but instead, that the barrier probably lies in the stimuli and procedures used.

We heartily agree. It is our belief that previous failures to find habituation in infants less than two months old have been due to the use of a fixed number of habituation trials on which the stimuli presented were so complex that young infants were unable to habituate to them in the time allowed. This belief is based on findings in the literature that:

1) older infants generally habituate faster than do younger infants;
2) simpler stimuli produce habituation more readily than do more complex stimuli.

In contrast to the usual finding on infants more than two months old, most studies of younger infants have failed to find a preference for a novel stimulus following a familiarization period. If younger infants do not really habituate, then it seems reasonable that they also do not subsequently prefer a novel stimulus. But, surprisingly, there have been several findings in young infants of increased preference for the familiar stimulus following exposure to it -- e.g., Wetherford and Cohen, 1973.

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Perhaps this is the time to introduce a necessary distinction, that between habituation and familiarization. Familiarization is taken to be any procedure of any duration that gives the infant perceptual experience with--that is, makes him more familiar with--a particular stimulus. This familiarization may or may not be sufficient to produce habituation, which is defined as a decrement in the infant's response to the familiarized stimulus down to some criterion level---for example, to less than 50% of the infant's original response to the stimulus.

The finding that infants who have been familiarized with, but not fully habituated to a stimulus, subsequently prefer that stimulus to a novel one fits very well with optimal level theories like those of Berlyne (1963) or Hunt (1965), which predict that as a stimulus becomes more familiar the infant's fixation on it should first increase and then decrease. Such an inverted U-shaped function is also suggested by the backward habituation curve obtained in four-month-olds by Cohen and Gelber (in press). They found that the curve obtained by plotting backward from the habituation criterion did not have the slow decline over trials characteristic of the forward habituation curve, but instead, the infants' looking increased with familiarization, reaching a peak immediately before a sudden drop to a low criterion level.

To summarize our own position: we feel that previous studies have generally failed to find habituation and response to novelty in infants younger than two months old because the stimuli used have been fairly complex, and a constant number of trials rather than an individual criterion of habituation has been used. The usual consequence has been that in the constant time allowed, most younger infants have either not become familiar with the stimulus at all--in which case they show no preference for either the so-called familiar stimulus or the so-called novel stimulus--or they have become familiarized

with the stimulus to some extent but not enough to habituate to it--in which case they end up preferring the familiar stimulus.

The following research was undertaken to test this point of view. Infants in three different groups were all given pre-tests to show that they had no initial preference for either of two stimuli, one of which was more complex than the other. The novel infants were given some familiarization with one of the stimuli, followed by a post-test on both stimuli to see if there was any preference for either the familiar or the novel (that is, unfamiliarized) stimulus.

The three groups were treated differently only during the familiarization period. The first group was run to habituation criterion on the simpler of the two stimuli. Our hypothesis was that this group would habituate rather quickly and then prefer the novel stimulus. The second group was also run to the same habituation criterion, but with the more complex stimulus. The hypothesis was that although this group would take longer to reach criterion, it would also habituate and prefer the novel stimulus. Finally, a third group was familiarized on the same complex stimulus that was shown to the second group, but was allowed only half as many familiarization trials. It was our hypothesis that this group would not reach the habituation criterion and would subsequently prefer the familiar rather than the novel stimulus.

Each of the three groups contained eight subjects, four boys and four girls. The infants were between their 5-week and 6-week birthdays, and were volunteered for the research by their parents in response to a printed request given to mothers in maternity wards of three hospitals in the Greater Vancouver area. A total of 31 subjects were run, but 7 failed to complete the experimental session because of crying and fussing.

The stimuli were black and white checkerboards, one a 2 x 2 and one an

8 x 8, each 4 1/2 inches square. These checkerboards were chosen on the basis of data obtained by Brennan, Ames, and Moore (1966), who showed that 3-week-olds looked most at the 2 x 2, while 8-week-olds looked most at the 8 x 8. Subjects halfway between 3 and 8 weeks--that is, 5 to 6 weeks old--have been shown to look equally at both stimuli.

In the present study a stimulus, printed on a white card, was presented 11 inches above the infant's face and directly in his line of vision as he lay on his back inside an experimental chamber. Looking time on each trial was recorded by an observer, who watched the infant's eyes through a peephole beside the stimulus card, and pushed a button that activated a Rustrak event recorder whenever the infant was fixating the stimulus. Average agreement between 2 independent observers on 7 infants was 93%.

Throughout the entire session a trial started with the infant fixating the stimulus, and ended the first time after 15 seconds of presentation that the infant looked away from the stimulus. This definition of a trial was adopted as a compromise between the conventional fixed length of trial and the "infant control" procedure used by Horowitz et al. (1972) and by Cohen (1972), in which the length of trial is completely controlled by the infant, and consists essentially of the length of the infant's first fixation.

The inter-trial interval was approximately 10 seconds in duration, except when it was necessary to take longer to quiet a fussing infant. Unfortunately, with 5-week-olds this is a fairly frequent occurrence.

Each pre-test and post-test consisted of 2 trials on each of the two stimuli in an ABBA order, A representing the stimulus not being familiarized, and B the stimulus familiarized. After the pre-test, members of Group 1 were presented with the 2 x 2 stimulus and run to a stringent criterion of habituation. The criterion was 2 consecutive sets of 3 consecutive trials during

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which the infant's average looking time was less than 1/2 of his average looking time on the first 3 habituation trials. The members of Group 2 were habituated to the same criterion on the 8 x 8 checkerboard. The members of Group 3 were also presented with the 8 x 8 checkerboard, but were allowed only the average number of familiarization trials that members of Group 1 had taken to reach criterion on the 2 x 2 checkerboard.

The results obtained for the 3 groups are shown in 3 separate figures, (Figures 1, 2, 3). Each figure shows the mean number of seconds per trial spent fixating the 2 x 2 and the 8 x 8 on the pre-test, and the same 2 stimuli on the post-test. Between pre- and post-tests is a backward habituation curve, the plotted points showing mean looking times for all trials on which at least 1/2 of the subjects in a group were represented.

Figure 1 shows the results for Group 1, which was run to criterion on the simple 2 x 2 stimulus. All 8 members of Group 1 habituated. The number of trials to reach criterion ranged from 10 to 18, with a mean of 13.5 trials. On the post-test all 8 subjects looked longer at the novel 8 x 8 stimulus than at the familiar 2 x 2 stimulus.

Figure 2 shows the results for Group 2, which was run to criterion on the complex 8 x 8 stimulus. All 8 members of Group 2 habituated. The number of trials to reach criterion ranged from 16 to 39, with a mean of 26 trials--approximately twice the number of trials taken to reach criterion on the 2 x 2. On the post-test all 8 subjects looked longer at the novel 2 x 2 stimulus than at the familiar 8 x 8 stimulus.

Figure 3 shows Group 3, which was familiarized with the 8 x 8 stimulus for 13 trials, the same number of trials it took Group 1 to reach criterion on the 2 x 2, but only 1/2 the number of trials it took Group 2 to reach criterion on the 8 x 8. Since none of the subjects in this group came anywhere near

reaching criterion, their position on the Trials from Habituation continuum has been estimated by assuming they would have taken as long as did Group 2 to reach criterion on the same stimulus. In this group on the post-test all 8 subjects looked longer at the familiar 8 x 8 stimulus than at the novel 2 x 2 stimulus.

Analysis of variance of looking times at the two stimuli revealed a significant Groups x Pre-Post x Stimulus Complexity interaction, $F(2, 21) = 6.36$, $p < .01$. Individual t-tests of differences between times spent looking at the 2 x 2 and times spent looking at 8 x 8 showed that while there were no significant differences during the pre-tests, post-tests in all 3 groups were significant at .01 or better. More compelling than significance levels, however, is the agreement among the subjects. To put it simply, every one of the 16 infants who habituated then preferred the novel stimulus, and every one of the 8 infants who were familiarized but not allowed to reach habituation preferred the familiar stimulus.

We believe that these data show:

1. that 5-week-old infants do habituate to visual stimuli,
2. that previous failures to demonstrate habituation have been due to stimulus and procedural limitations rather than to any inherent inability of young infants,

and 3. that preference for novelty is found following the attainment of a stringent individual habituation criterion, while preference for familiarity is found following a period of familiarization too short to permit the attainment of such a criterion.

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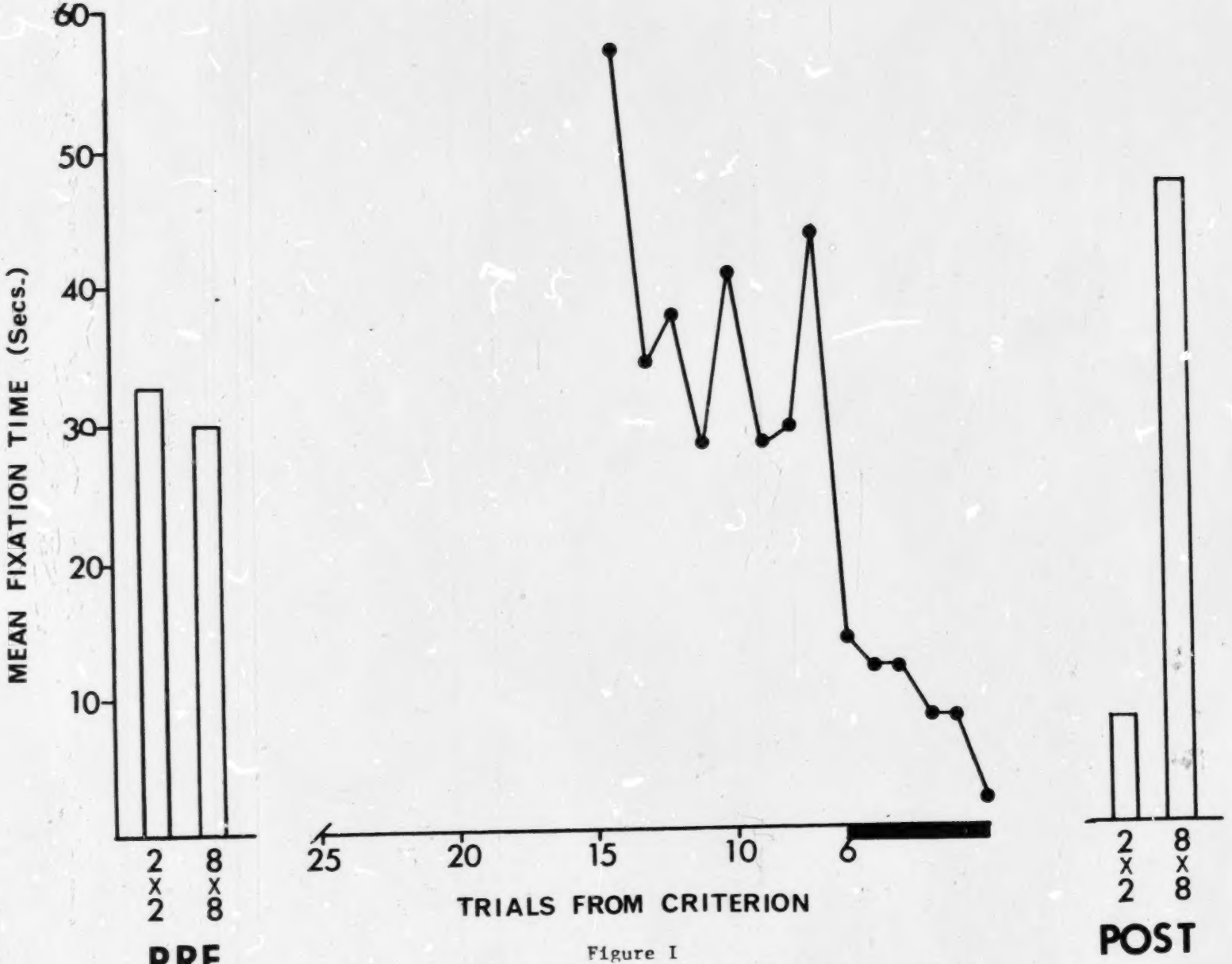

Figure I

Pre, post, and habituation looking time for Group 1, run to habituation criterion on 2 x 2 stimulus.

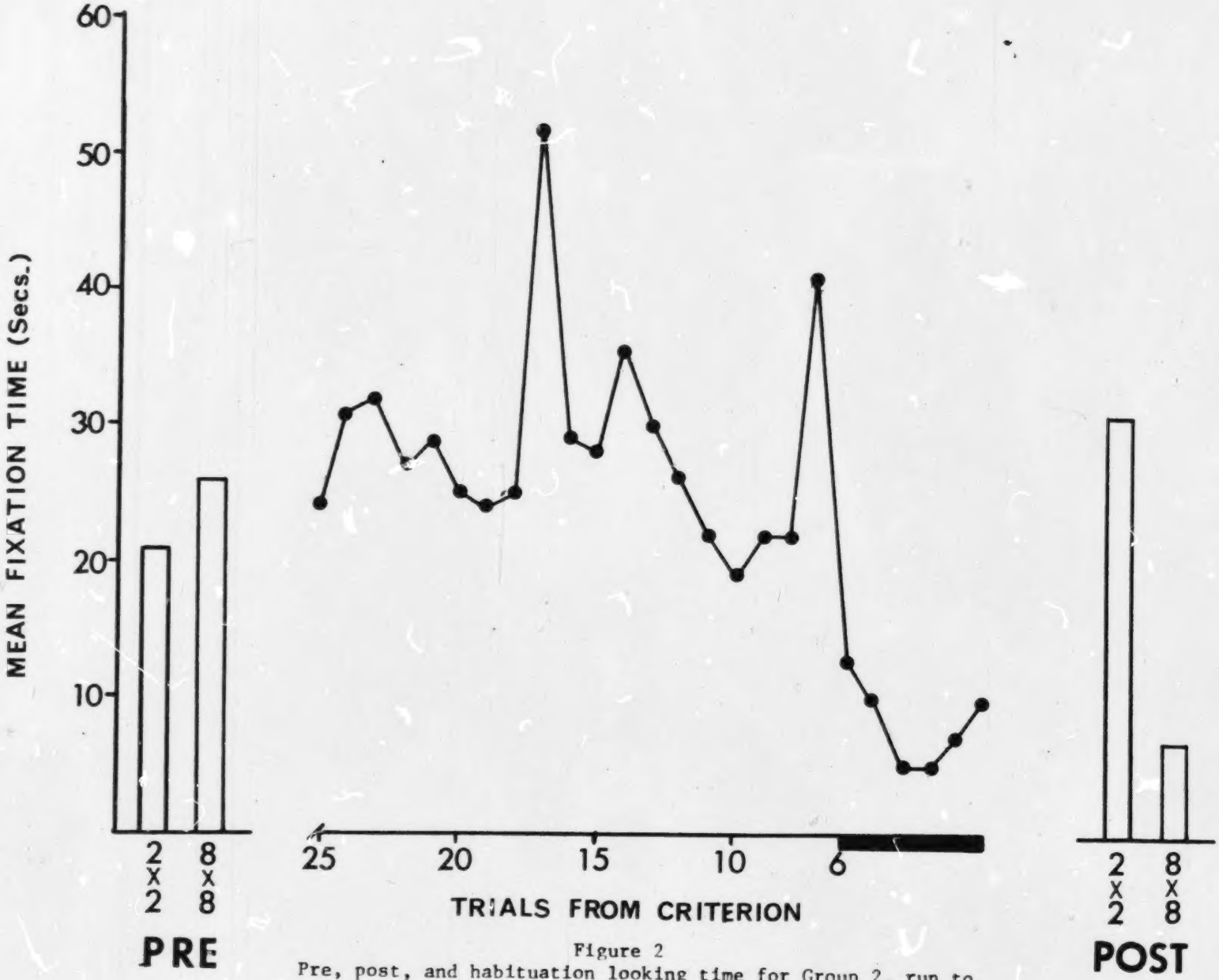

Figure 2
Pre, post, and habituation looking time for Group 2, run to habituation criterion on 8 x 8 stimulus.

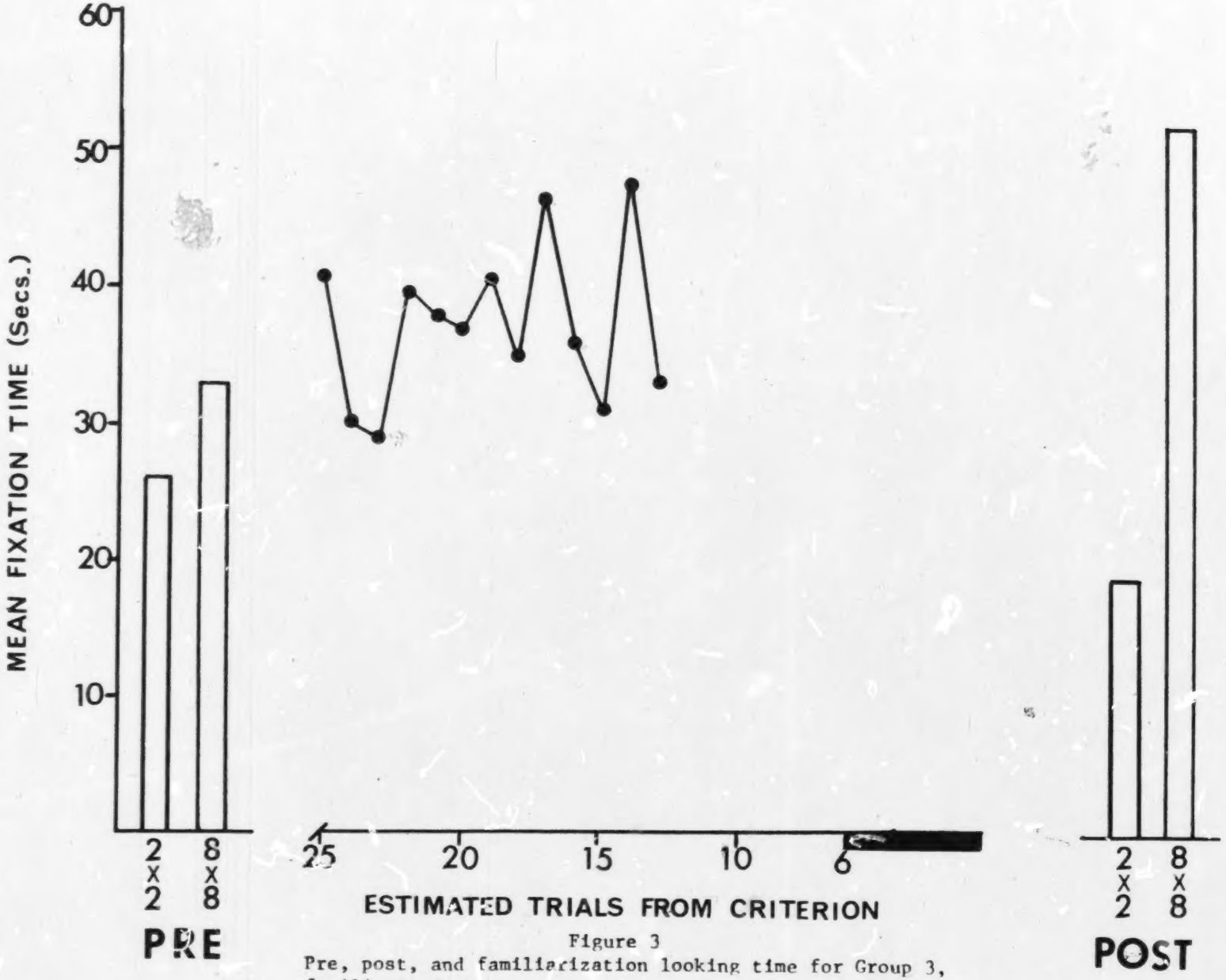

Figure 3
Pre, post, and familiarization looking time for Group 3, familiarized, but not reaching criterion, on 8 x 8 stimulus.